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WHAT IS CLAIMED IS:

1. A switchable slanted transmission grating comprising a polymer-dispersed liquid crystal material disposed between at least two optically transparent electrode plates, wherein the polymer-dispersed liquid crystal material is constructed by exposing to light
- 5 in an interference pattern a mixture comprising, before exposure:
- (a) a polymerizable monomer comprising at least one acrylate;
 - (b) at least one liquid crystal;
 - (c) a chain-extending monomer;
 - (d) a coinitiator; and
 - 10 (e) a photoinitiator.
2. The switchable slanted transmission grating according to Claim 1, wherein the polymerizable monomer comprises a mixture of di-, tri-, tetra-, and pentaacrylates.
- 15 3. The switchable slanted transmission grating according to Claim 2, wherein the polymerizable monomer is at least one acrylate selected from the group consisting of triethyleneglycol diacrylate, trimethylolpropane triacrylate, pentaerythritol triacrylate, pentaerythritol tetracrylate, and dipentaerythritol pentaacrylate.
- 20 4. The switchable slanted transmission grating according to Claim 3, wherein the polymerizable monomer comprises a mixture of tri- and pentaacrylates.

5. The switchable slanted transmission grating according to Claim 4, wherein the polymerizable monomer comprises dipentaerythritol pentaacrylate.

6. The switchable slanted transmission grating according to Claim 1, wherein the at least one liquid crystal is at least one liquid crystal selected from the group consisting of a mixture of cyanobiphenyls, 4'-n-pentyl-4-cyanobiphenyl, 4'-n-heptyl-4-cyanobiphenyl, 4'-octaoxy-4-cyanobiphenyl, 4'-pentyl-4-cyanoterphenyl, and α -methoxybenzylidene-4'-butylaniline.

7. The switchable slanted transmission grating according to Claim 6, wherein the at least one liquid crystal comprises a mixture of cyanobiphenyls.

8. The switchable slanted transmission grating according to Claim 1, wherein the chain-extending monomer is at least one member selected from the group consisting of N-vinyl pyrrolidone, N-vinyl pyridine, acrylonitrile, and N-vinyl carbazole.

9. The switchable slanted transmission grating according to Claim 8, wherein the chain-extending monomer is N-vinyl pyrrolidone.

10. The switchable slanted transmission grating according to Claim 1, wherein the coinitiator is at least one member selected from the group consisting of N-

phenylglycine, triethylene amine, triethanolamine, and N, N-dimethyl-2,6-diisopropyl aniline.

11. The switchable slanted transmission grating according to Claim 10,
5 wherein the coinitiator is N-phenylglycine.

12. The switchable slanted transmission grating according to Claim 1, wherein
the photoinitiator is at least one member selected from the group consisting of rose bengal
ester, rose bengal sodium salt, eosin, eosin sodium salt, 4,5-diiodosuccinyl fluorescein,
10 camphorquinone, methylene blue, cationic cyanine dyes with trialkylborate anions, and
merocyanine dyes derived from spiropyran.

13. The switchable slanted transmission grating according to Claim 12,
wherein the photoinitiator is rose bengal sodium salt.

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14. The switchable slanted transmission grating according to Claim 1, wherein
the polymer-dispersed liquid crystal material, before exposure, further comprises a
surfactant.

15. The switchable slanted transmission grating according to Claim 14,
20 wherein the surfactant is octanol.

16. The switchable slanted transmission grating according to Claim 1, wherein the polymerizable monomer comprises dipentaerythritol pentaacrylate, the at least one liquid crystal comprises a mixture of cyanobiphenyls, the chain-extending monomer is N-vinyl pyrrolidone, the coinitiator is N-phenylglycine, and the photoinitiator is rose bengal sodium salt.

17. An optical coupling device comprising:

at least one switchable slanted transmission grating according to Claim 1; and

at least one voltage source associated with said switchable slanted transmission grating.

18. The optical coupling device according to Claim 17, wherein the optical coupling device further comprises at least one transparent substrate.

19. The optical coupling device according to Claim 18, wherein the at least one switchable slanted transmission grating is coupled to the at least one transparent substrate.

20. The optical coupling device according to Claim 19, wherein the at least one transparent substrate is glass.

21. The optical coupling device according to Claim 20, wherein the polymerizable monomer comprises dipentaerythritol pentaacrylate.

22. The optical coupling device according to Claim 17, wherein the optical coupling device is a selectively adjustable and reconfigurable one-to-many fan-out optical coupling device.

23. The optical coupling device according to Claim 22, wherein the at least one liquid crystal comprises a mixture of cyanobiphenyls.

24. The optical coupling device according to Claim 18, wherein the average index of refraction of the at least one switchable slanted transmission grating is similar to the refractive index of the at least one transparent substrate.

25. The optical coupling device according to Claim 24, wherein the chain-extending monomer is N-vinyl pyrrolidone.

26. The optical coupling device according to Claim 17, wherein the optical coupling device further comprises at least one transparent electrode.

27. The optical coupling device according to Claim 26, wherein the coinitiator is N-phenylglycine.

28. The optical coupling device according to Claim 18, wherein the at least one switchable slanted transmission grating has a slant angle, θ_s , and the at least one transparent substrate has a critical angle, θ_c , for total internal reflection and wherein
5 $2\theta_s > \theta_c$.

29. The optical coupling device according to Claim 28, wherein the photoinitiator is rose bengal sodium salt.

10 30. The optical coupling device according to Claim 17, wherein the polymer-dispersed liquid crystal material, before exposure, further comprises a surfactant.

31. The optical coupling device according to Claim 30, wherein the surfactant is octanol.

15 32. The optical coupling device according to Claim 17, wherein an anti-reflective coating is applied to the at least one switchable slanted transmission grating.

20 33. The optical coupling device according to Claim 17, wherein the polymerizable monomer comprises dipentaerythritol pentaacrylate, the at least one liquid crystal comprises a mixture of cyanobiphenyls, the chain-extending monomer is N-vinyl

pyrrolidone, the coinitiator is N-phenylglycine, and the photoinitiator is rose bengal sodium salt.

34. A method for preparing a switchable slanted transmission grating,
5 comprising:

disposing between at least two optically transparent electrode plates, a mixture that comprises, before exposure:

- (a) a polymerizable monomer comprising at least one acrylate;
- (b) a liquid crystal;
- 10 (c) a chain-extending monomer;
- (d) a coinitiator; and
- (e) a photoinitiator;

and

exposing this mixture to light in an interference pattern.

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35. The method for preparing a switchable slanted transmission grating according to Claim 34, wherein the polymerizable monomer comprises a mixture of di-, tri-, tetra-, and pentaacrylates.

20 36. The method for preparing a switchable slanted transmission grating according to Claim 35, wherein the polymerizable monomer is at least one acrylate selected from the group consisting of triethyleneglycol diacrylate, trimethylolpropane

triacrylate, pentaerythritol triacrylate, pentaerythritol tetracrylate, and dipentaerythritol pentaacrylate.

37. The method for preparing a switchable slanted transmission grating
5 according to Claim 36, wherein the polymerizable monomer comprises a mixture of tri-
and pentaacrylates.

38. The method for preparing a switchable slanted transmission grating
10 according to Claim 37, wherein the polymerizable monomer comprises dipentaerythritol
pentaacrylate.

39. The method for preparing a switchable slanted transmission grating
according to Claim 34, wherein the at least one liquid crystal is at least one liquid crystal
selected from the group consisting of a mixture of cyanobiphenyls, 4'-n-pentyl-4-
15 cyanobiphenyl, 4'-n-heptyl-4-cyanobiphenyl, 4'-octaoxy-4-cyanobiphenyl, 4'-pentyl-4-
cyanoterphenyl, and α -methoxybenzylidene-4'-butylaniline.

40. The method for preparing a switchable slanted transmission grating
according to Claim 39, wherein the at least one liquid crystal comprises a mixture of
20 cyanobiphenyls.

41. The method for preparing a switchable slanted transmission grating according to Claim 34, wherein the chain-extending monomer is at least one member selected from the group consisting of N-vinyl pyrrolidone; N-vinyl pyridine, acrylonitrile, and N-vinyl carbazole.

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42. The method for preparing a switchable slanted transmission grating according to Claim 41, wherein the chain-extending monomer is N-vinyl pyrrolidone.

43. The method for preparing a switchable slanted transmission grating according to Claim 34, wherein the coinitiator is at least one member selected from the group consisting of N-phenylglycine, triethylene amine, triethanolamine, and N, N-dimethyl-2,6-diisopropyl aniline.

44. The method for preparing a switchable slanted transmission grating according to Claim 43, wherein the coinitiator is N-phenylglycine.

45. The method for preparing a switchable slanted transmission grating according to Claim 34, wherein the photoinitiator is at least one member selected from the group consisting of rose bengal ester, rose bengal sodium salt, eosin, eosin sodium salt, 4,5-diiodosuccinyl fluorescein, camphorquinone, methylene blue, cationic cyanine dyes with trialkylborate anions, and merocyanine dyes derived from spiropyran.

46. The method for preparing a switchable slanted transmission grating according to Claim 45, wherein the photoinitiator is rose bengal sodium salt.

47. The method for preparing a switchable slanted transmission grating according to Claim 34, wherein the polymer-dispersed liquid crystal material, before exposure, further comprises a surfactant.

48. The method for preparing a switchable slanted transmission grating according to Claim 47, wherein the surfactant is octanol.

49. The method for preparing a switchable slanted transmission grating according to Claim 34, wherein the light in an interference pattern is obtained from at least two beams of coherent light.

50. The method for preparing a switchable slanted transmission grating according to Claim 49, wherein one beam of coherent light arrives at the mixture with a ~~large~~ angle of incidence with respect to the second beam.

51. The method for preparing a switchable slanted transmission grating according to Claim 34, wherein the polymerizable monomer comprises dipentaerythritol pentaacrylate, the at least one liquid crystal comprises a mixture of cyanobiphenyls, the

chain-extending monomer is N-vinyl pyrrolidone, the coinitiator is N-phenylglycine, and the photoinitiator is rose bengal sodium salt.

52. A method for preparing an optical coupling device comprising
5 constructing a switchable slanted transmission grating according to Claim 34, and electrically connecting said optically transparent electrodes to a voltage source.

53. The method for preparing an optical coupling device according to Claim
52, wherein the optical coupling device further comprises at least one transparent
10 substrate.

54. The method for preparing an optical coupling device according to Claim
53, wherein the at least one switchable slanted transmission grating is coupled to the at
least one transparent substrate.

55. The method for preparing an optical coupling device according to Claim
54, wherein the at least one transparent substrate is glass.

56. The method for preparing an optical coupling device according to Claim
20 55, wherein the polymerizable monomer comprises dipentaerythritol pentaacrylate.

57. The method for preparing an optical coupling device according to Claim 52, wherein the optical coupling device is a selectively adjustable and reconfigurable one-to-many fan-out optical coupling device.

5 58. The method for preparing an optical coupling device according to Claim 57, wherein the at least one liquid crystal comprises a mixture of cyanobiphenyls.

59. The method for preparing an optical coupling device according to Claim 52, wherein the average index of refraction of the at least one switchable slanted
10 transmission grating is similar to the refractive index of the at least one transparent substrate.

60. The method for preparing an optical coupling device according to Claim 59, wherein the chain-extending monomer is N-vinyl pyrrolidone.

15 61. The method for preparing an optical coupling device according to Claim 52, wherein the optical coupling device further comprises at least one transparent electrode.

20 62. The method for preparing an optical coupling device according to Claim 61, wherein the coinitiator is N-phenylglycine.

monomer is N-vinyl pyrrolidone, the coinitiator is N-phenylglycine, and the photoinitiator is rose bengal sodium salt.

69. A selectively adjustable and reconfigurable one-to-many fan-out optical
5 interconnect, comprising an input optical coupling device and one or more output optical
coupling devices in optical contact with a substrate capable of transmitting light
therebetween, wherein at least one of said optical coupling devices are according to
Claim 17.

10 70. A holographic optical element comprising at least one optical coupling
device according to Claim 17 in optical contact with a substrate capable of transmitting
light.